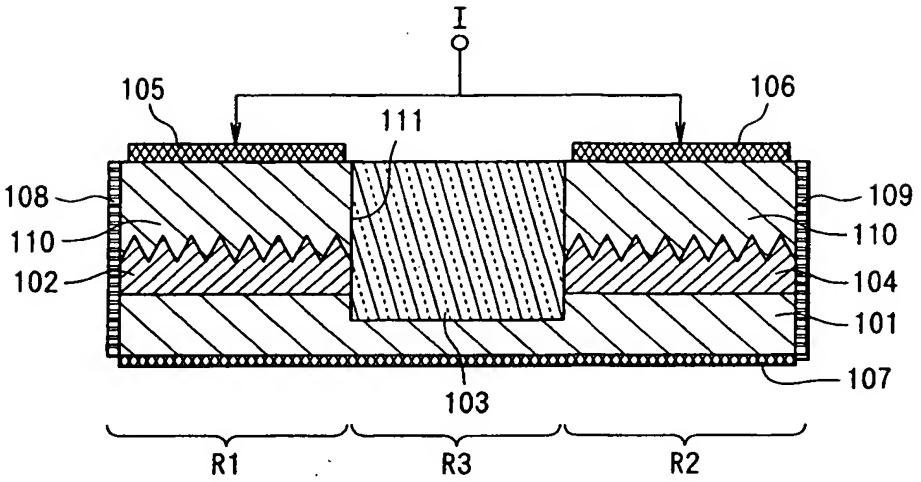
I
105
106
111
108
109
110
110
102
104
101
107
103
R1
R3
R2

FIG.1

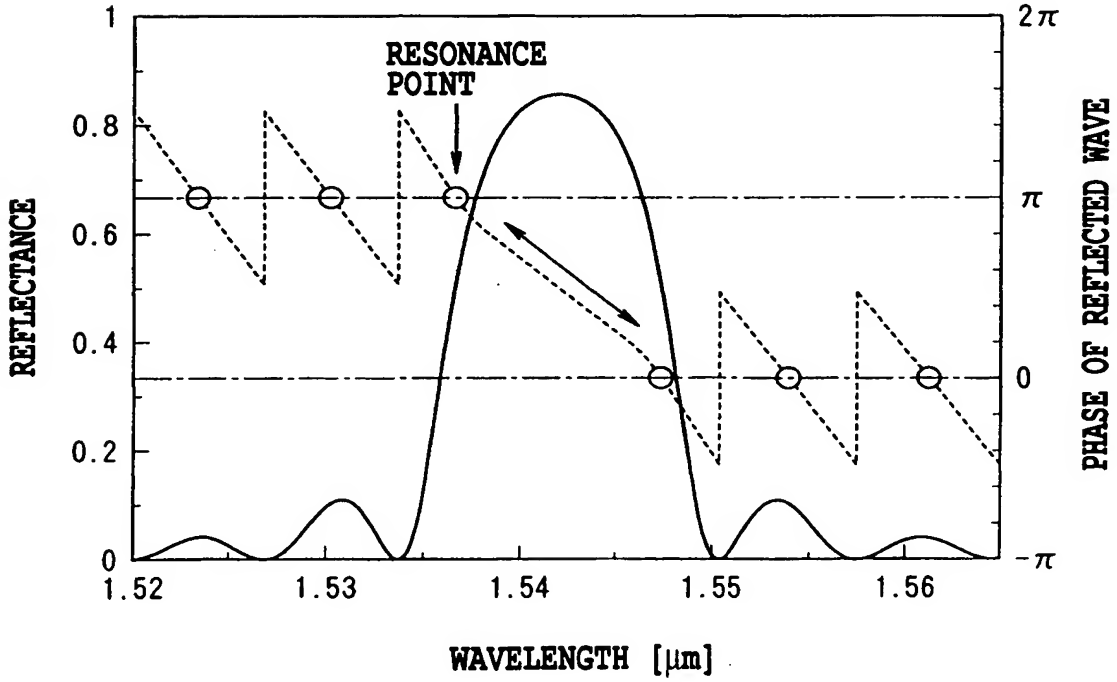
RESONANCE POINT
REFLECTANCE
PHASE OF REFLECTED WAVE
WAVELENGTH [μm]
1
0.8
0.6
0.4
0.2
0
2π
π
0
-π
1.52
1.53
1.54
1.55
1.56

FIG.2

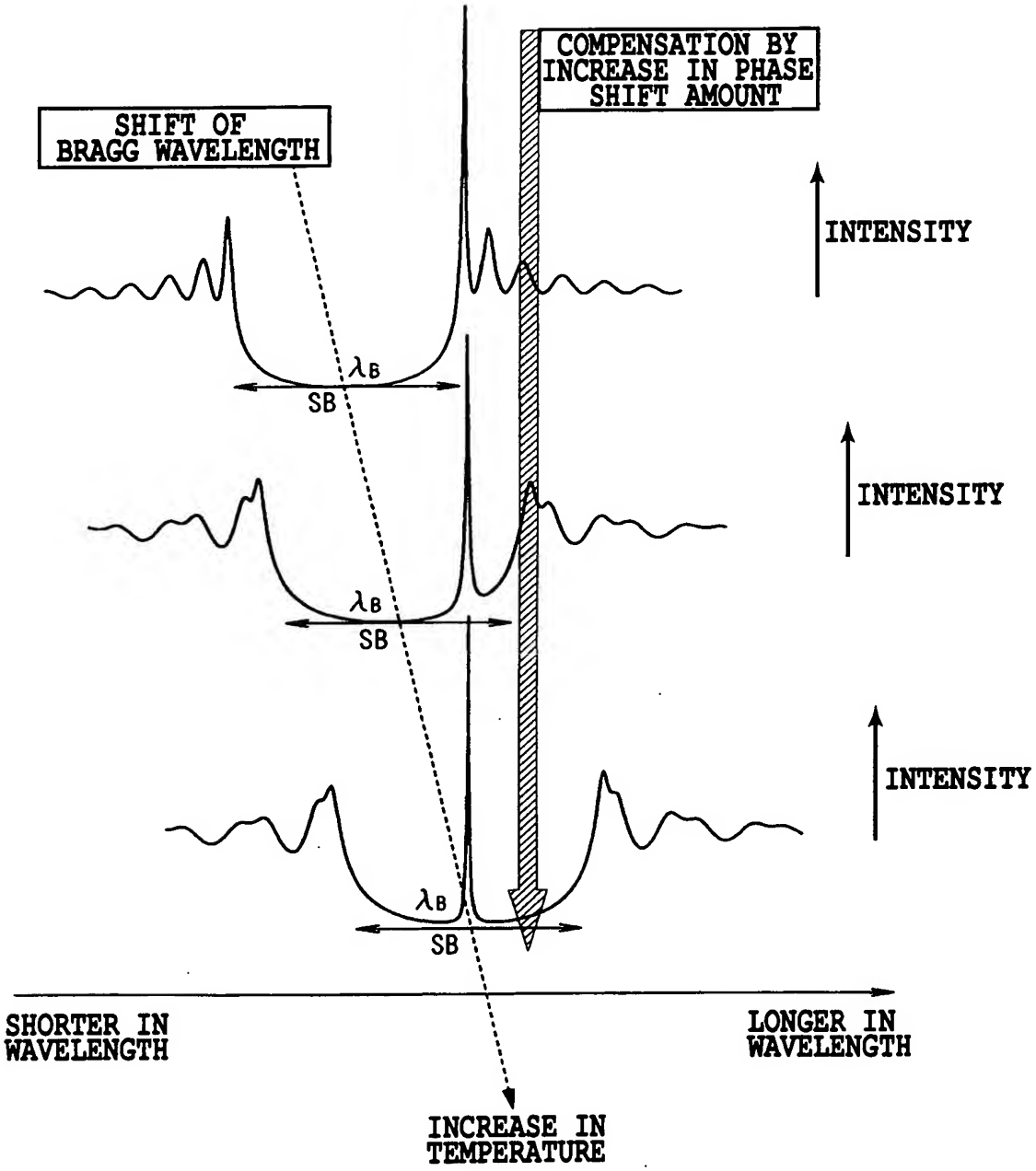
SHIFT OF BRAGG WAVELENGTH
COMPENSATION BY INCREASE IN PHASE SHIFT AMOUNT
INTENSITY
INTENSITY
INTENSITY
λB
SB
λB
SB
λB
SB
SHORTER IN WAVELENGTH
LONGER IN WAVELENGTH
INCREASE IN TEMPERATURE

FIG.3

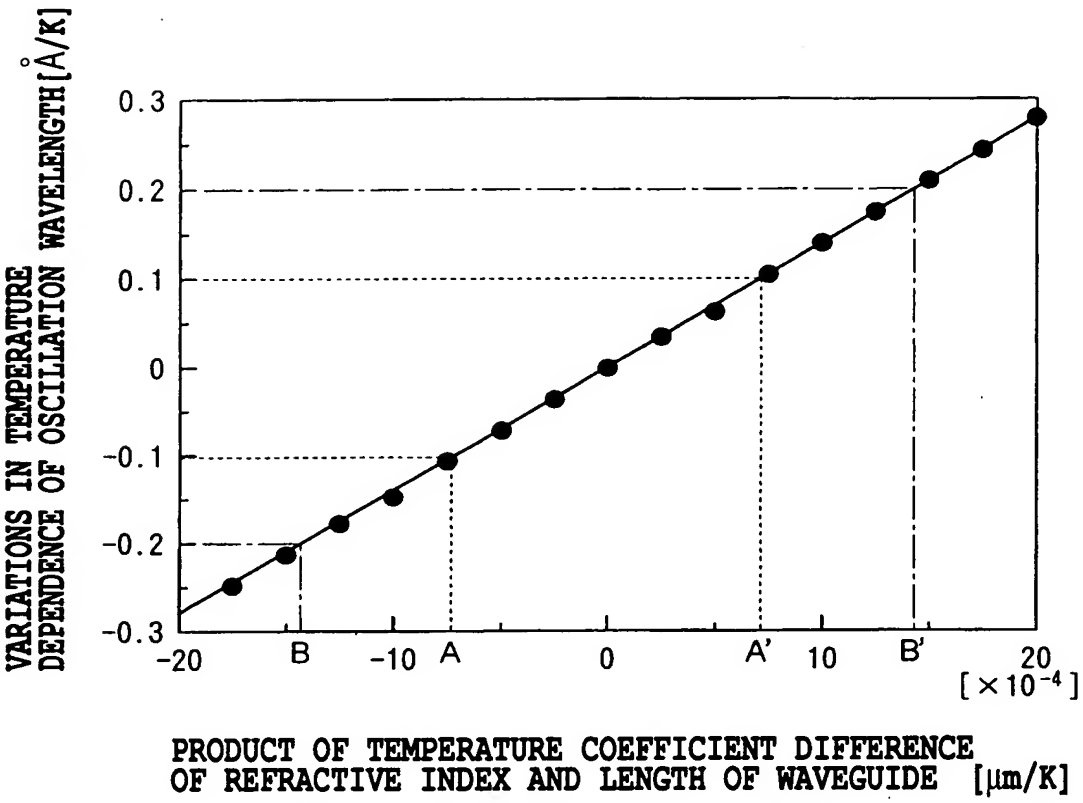
VARIATIONS IN TEMPERATURE DEPENDENCE OF OSCILLATION WAVELENGTH [Å/K]
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-20
B
-10
A
0
A'
10
B'
20
[×10⁻⁴]
PRODUCT OF TEMPERATURE COEFFICIENT DIFFERENCE OF REFRACTIVE INDEX AND LENGTH OF WAVEGUIDE [μm/K]

FIG.4

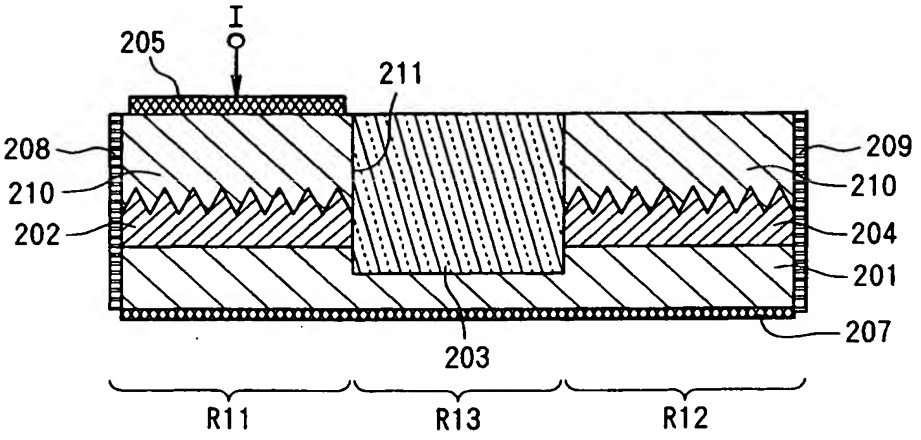
I
205
211
208
210
202
209
210
204
201
207
203
R11
R13
R12

FIG.5

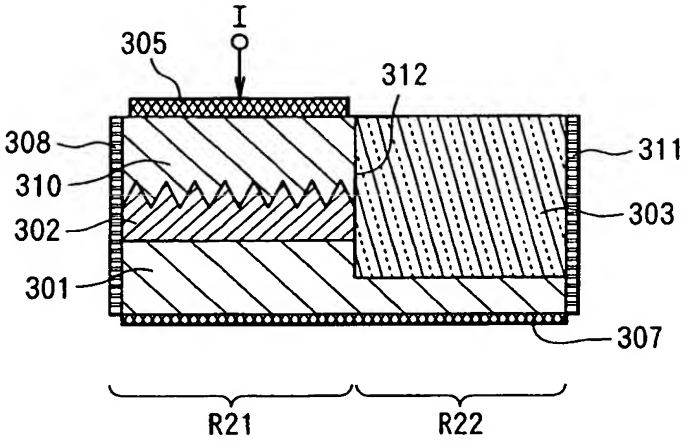
I
305
312
308
311
310
303
302
301
307
R21
R22

FIG.6

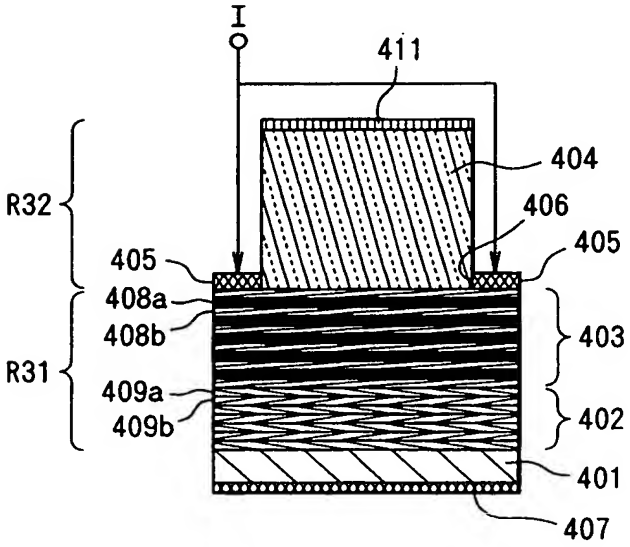
I
411
404
R32
406
405
405
408a
408b
403
R31
409a
402
409b
401
407

FIG.7

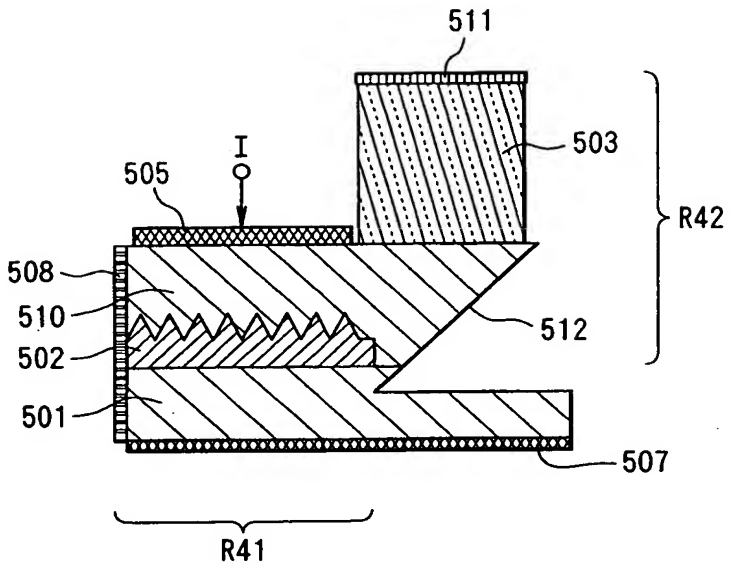

FIG.8

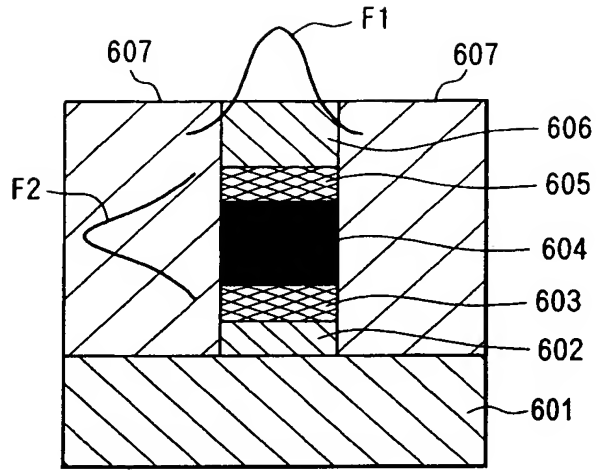

FIG.9A

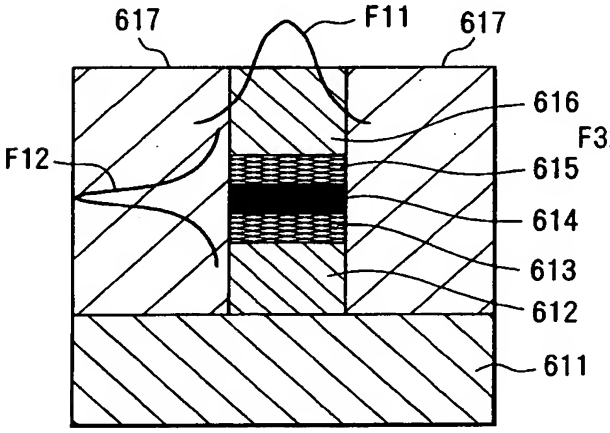

FIG.9B

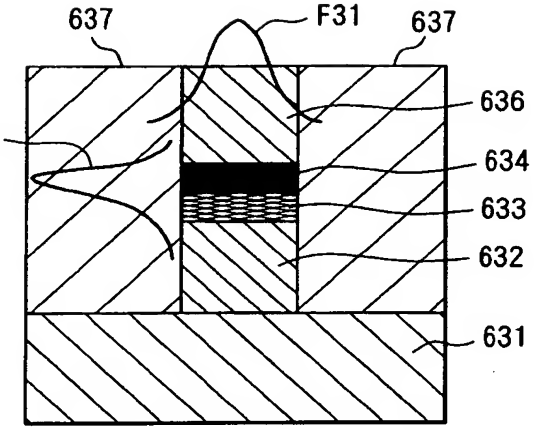

FIG.9D

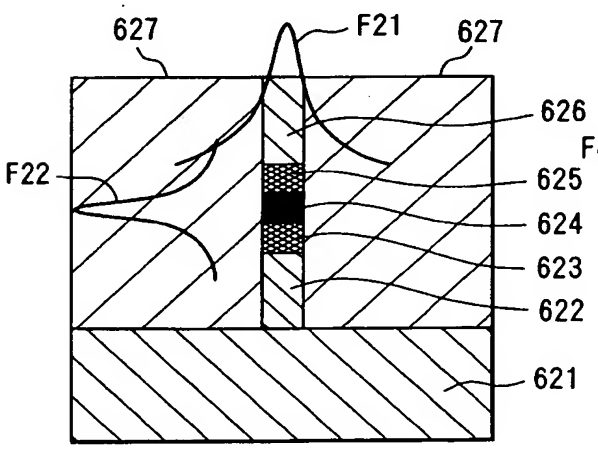

FIG.9C

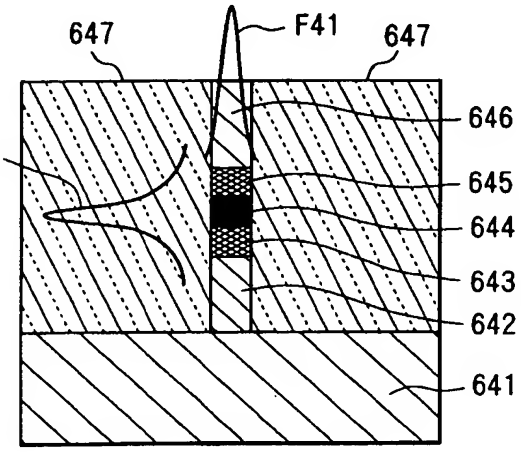

FIG.9E

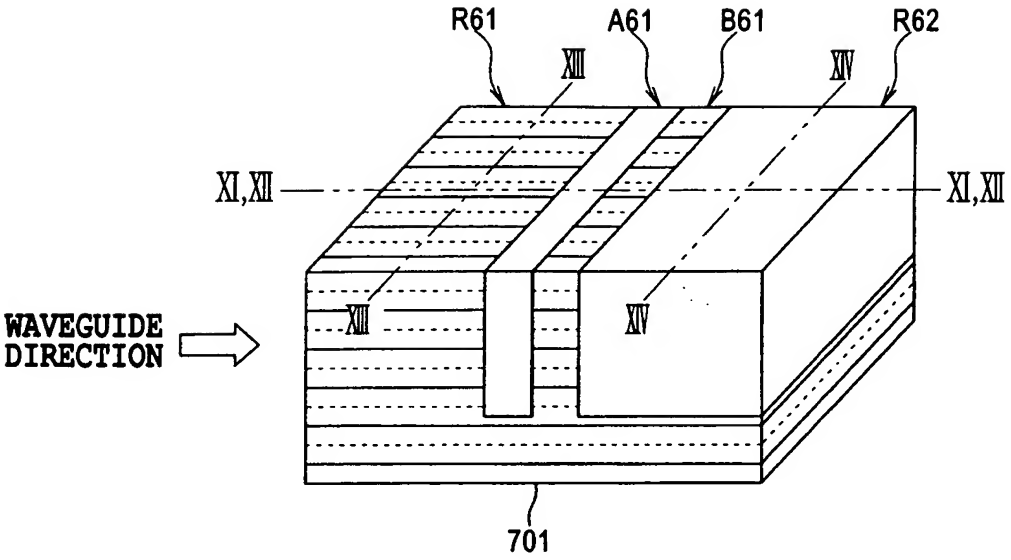
R61
A61
B61
R62
XIII
XIV
XI,XII
XI,XII
WAVEGUIDE DIRECTION
XIII
XIV
701

FIG.10

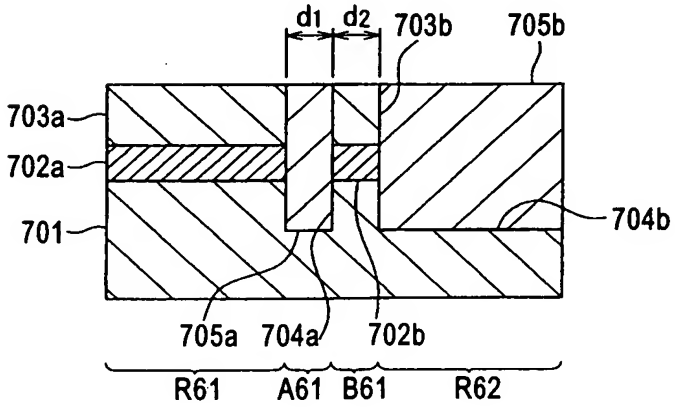
d1
d2
703b
705b
703a
702a
701
704b
705a
704a
702b
R61
A61
B61
R62

FIG.11

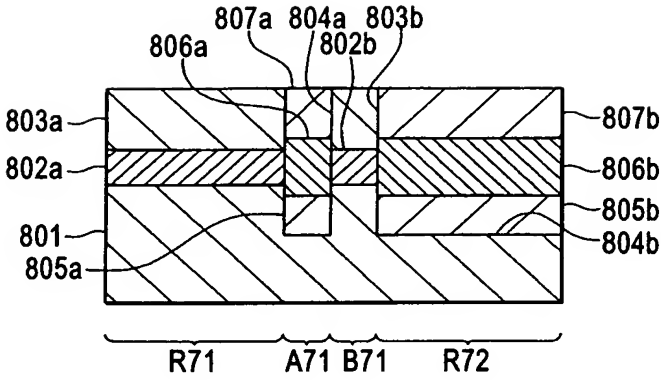
807a
804a
803b
806a
802b
803a
807b
802a
806b
805b
801
804b
805a
R71
A71
B71
R72

FIG.12

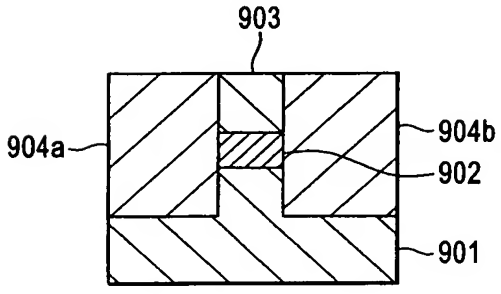
903
904a
904b
902
901

FIG.13

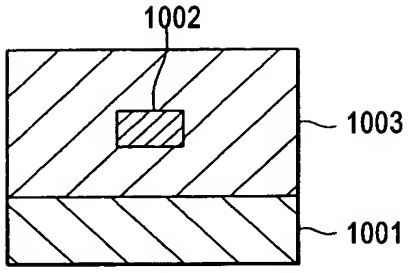

FIG.14

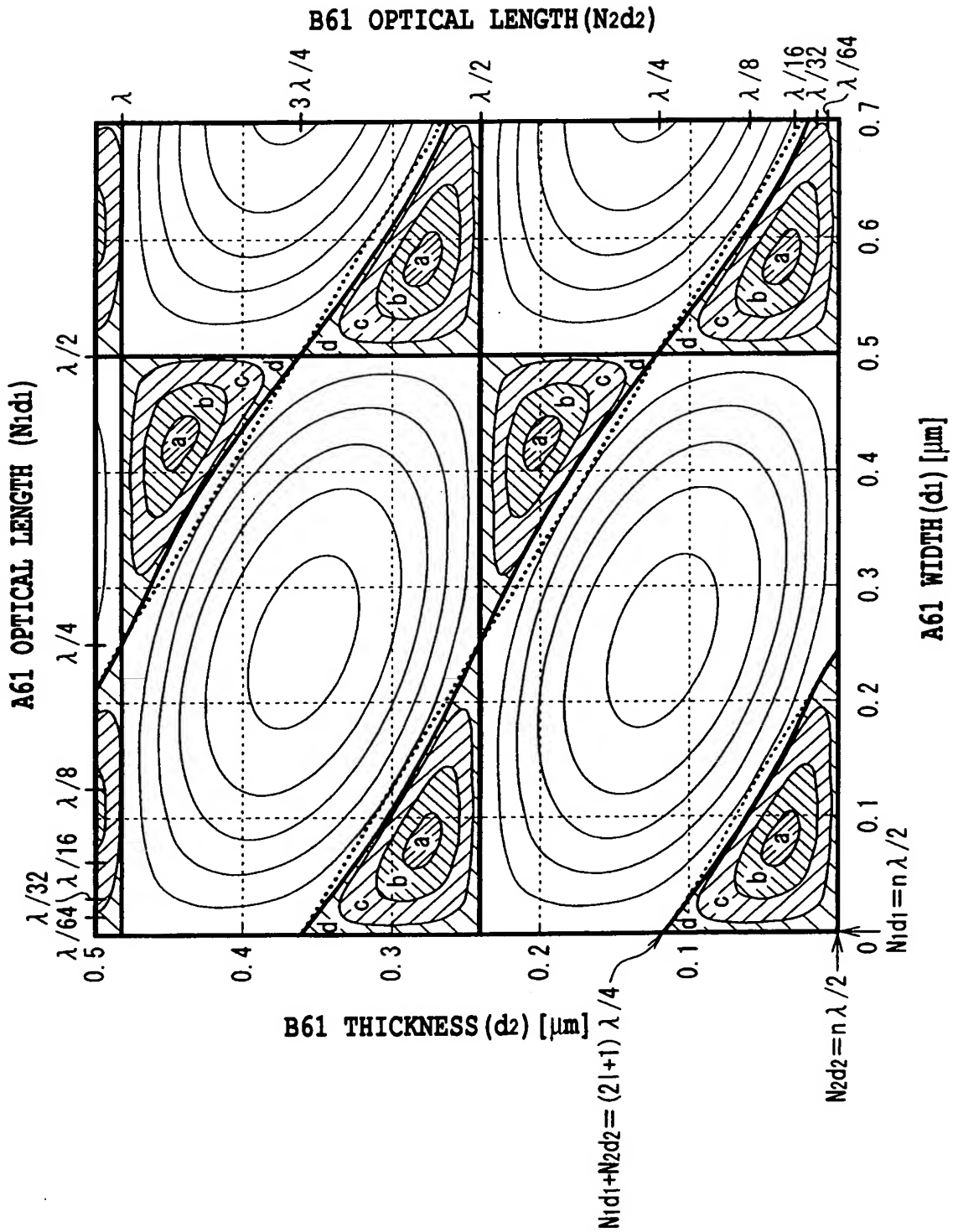
B61 OPTICAL LENGTH (N2d2)
λ
3λ/4
λ/2
λ/4
λ/8
λ/16
λ/32
λ/64
A61 OPTICAL LENGTH (N1d1)
A61 WIDTH (d1) [μm]
B61 THICKNESS (d2) [μm]
N1d1+N2d2= (2l+1) λ/4
N2d2=nλ/2
N1d1=nλ/2
0.5
0.4
0.3
0.2
0.1
0
0.7
0.6
0.5
0.4
0.3
0.2
0.1
a
b
c
d

FIG.15

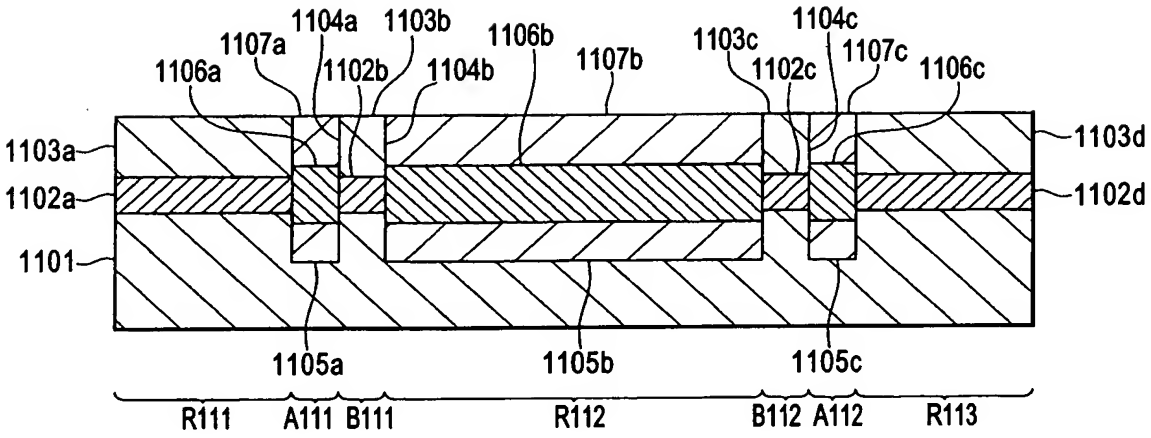
1104a
1103b
1104c
1107a
1106b
1103c
1107c
1106a
1102b
1104b
1107b
1102c
1106c
1103a
1103d
1102a
1102d
1101
1105a
1105b
1105c
R111
A111
B111
R112
B112
A112
R113

FIG.16

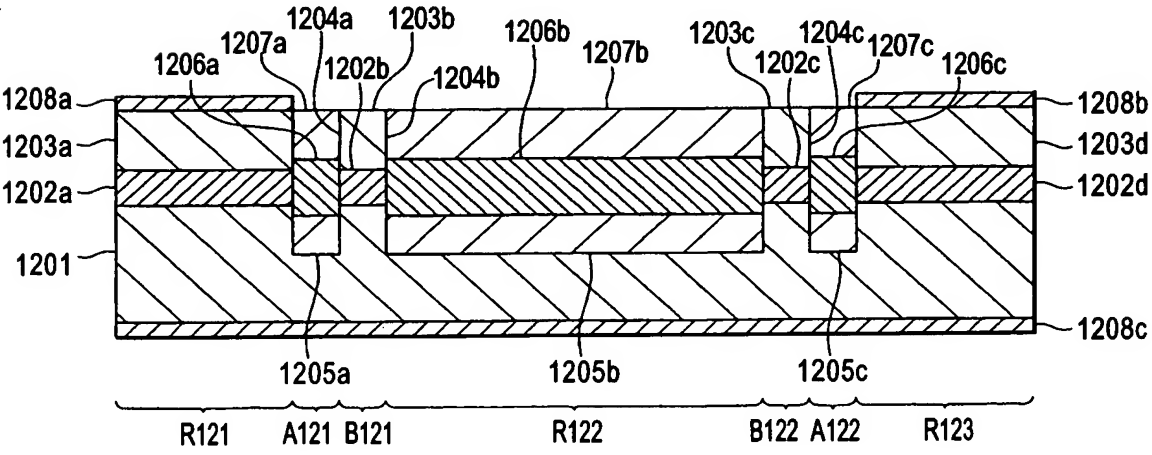
1204a
1203b
1206b
1203c
1204c
1207a
1207c
1206a
1202b
1204b
1207b
1202c
1206c
1208a
1208b
1203a
1203d
1202a
1202d
1201
1208c
1205a
1205b
1205c
R121
A121
B121
R122
B122
A122
R123

FIG.17

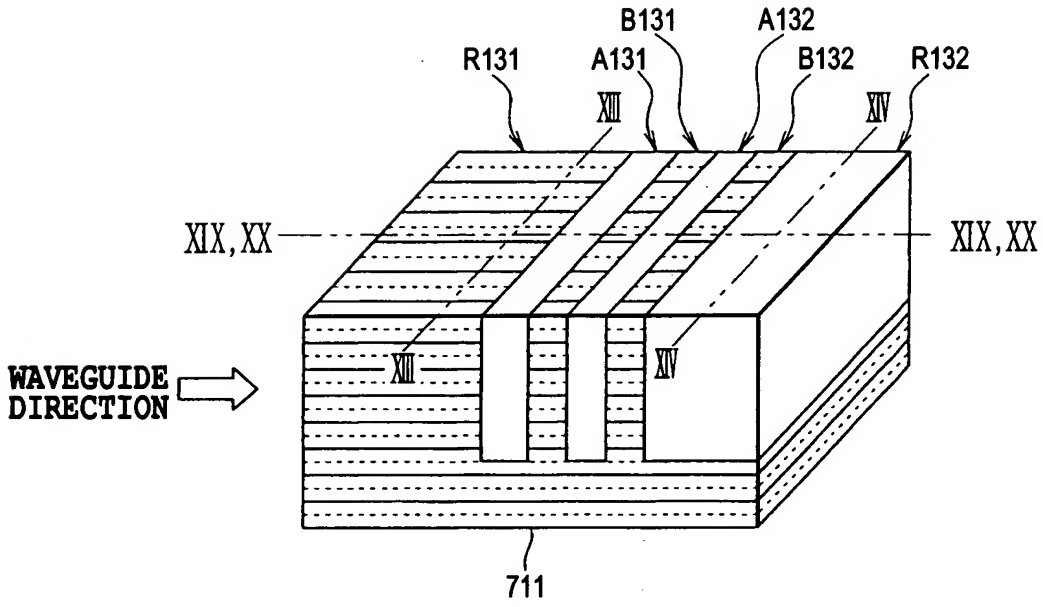
B131
A132
R131
A131
B132
R132
XIII
XIV
XIX, XX
XIX, XX
WAVEGUIDE DIRECTION
XIII
XIV
711

FIG.18

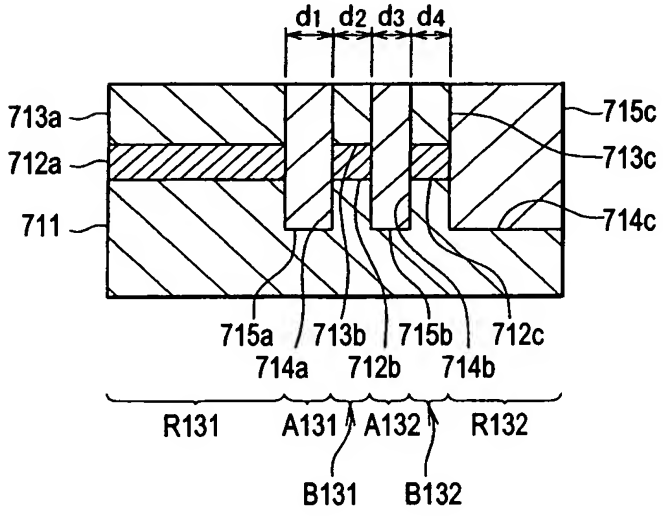
d1 d2 d3 d4
713a
712a
711
715c
713c
714c
715a
714a
713b
712b
715b
714b
712c
R131
A131
A132
R132
B131
B132

FIG.19

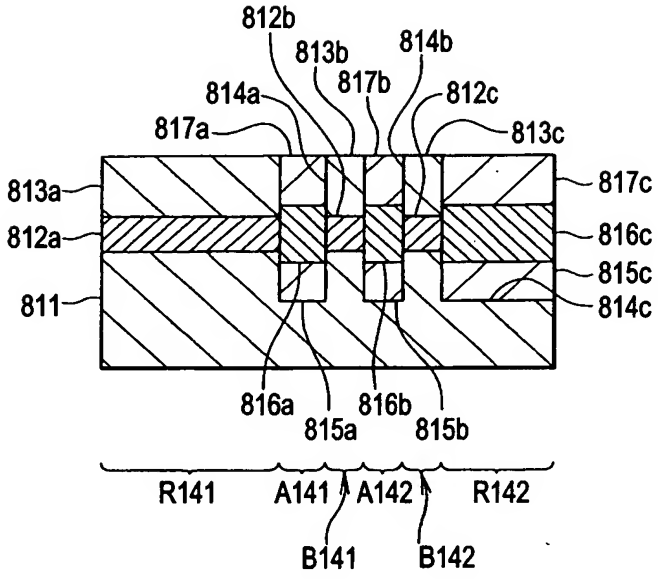
812b
813b
814b
817b
814a
812c
817a
813c
813a
817c
812a
816c
815c
811
814c
816a
815a
816b
815b
R141
A141
A142
R142
B141
B142

FIG.20

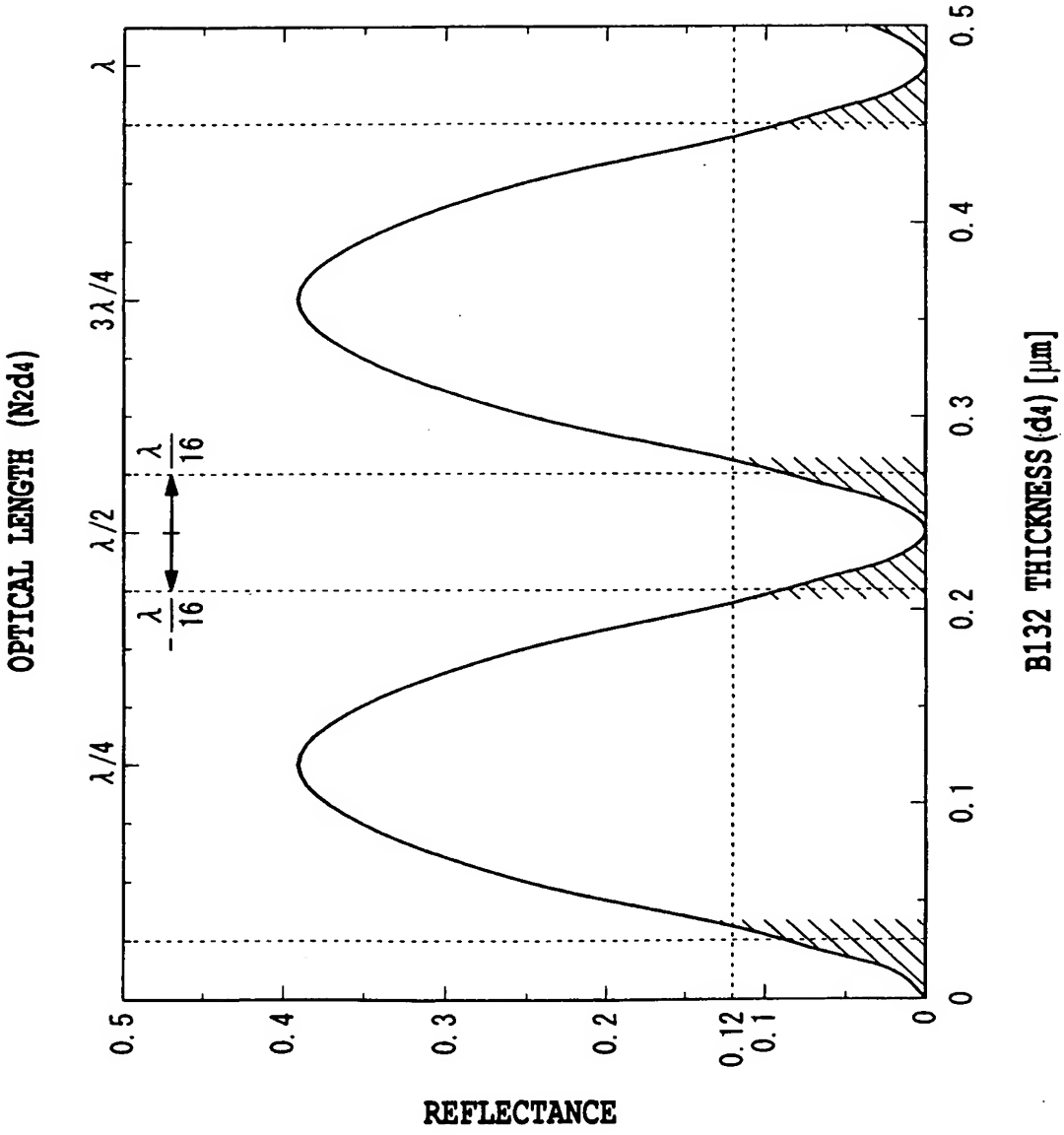
OPTICAL LENGTH (N2d4)
λ
3λ/4
λ/2
λ/4
λ/16
-λ/16
0.5
0.4
0.3
0.2
0.12
0.1
0
REFLECTANCE
0
0.1
0.2
0.3
0.4
0.5
B132 THICKNESS (d4) [μm]

FIG.21

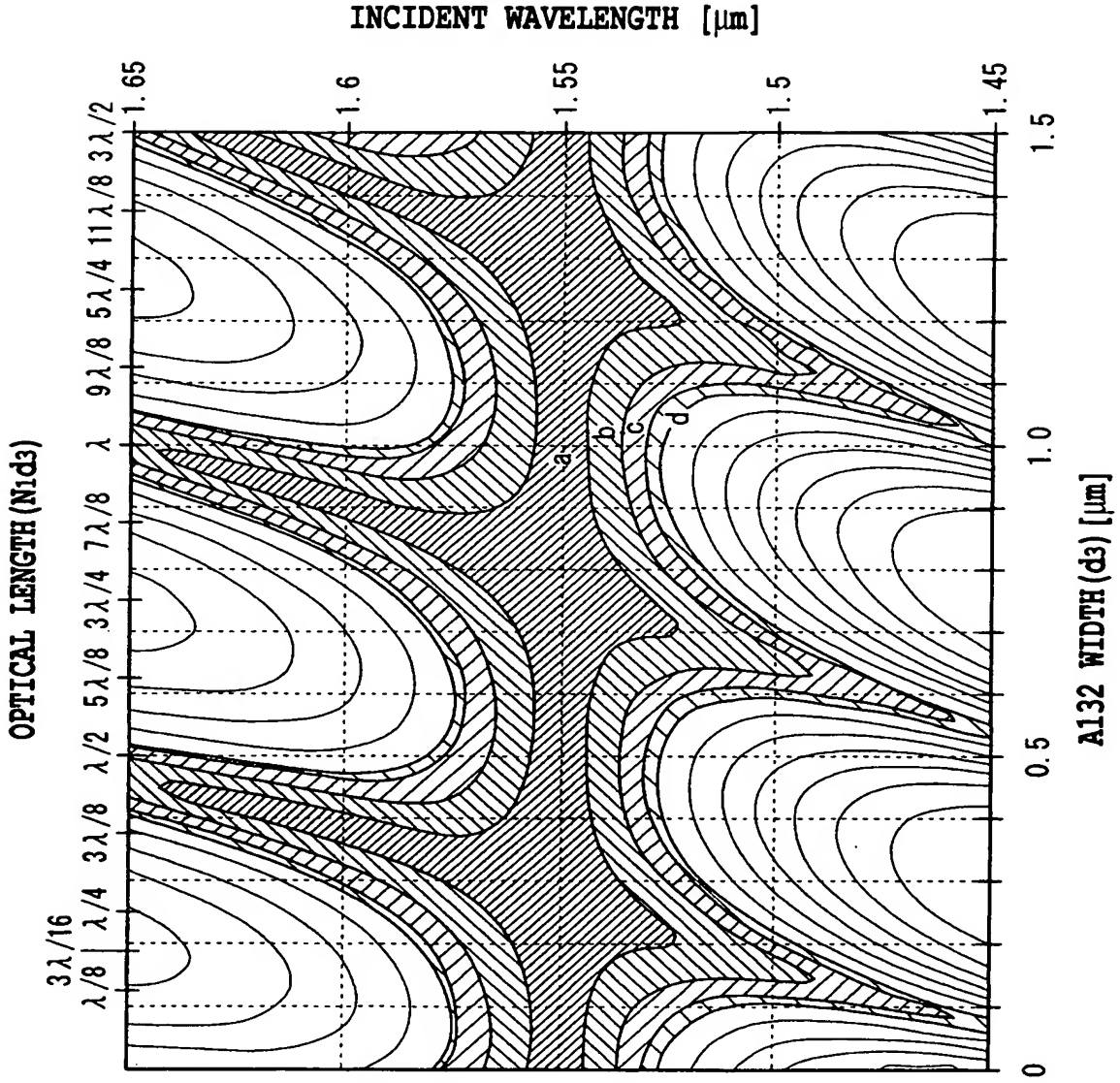
INCIDENT WAVELENGTH [μm]
1.65
1.6
1.55
1.5
1.45
OPTICAL LENGTH (N1d3)
λ/8
3λ/16
λ/4
3λ/8
λ/2
5λ/8
3λ/4
7λ/8
λ
9λ/8
5λ/4
11λ/8
3λ/2
a
b
c
d
0
0.5
1.0
1.5
A132 WIDTH (d3) [μm]

FIG.22

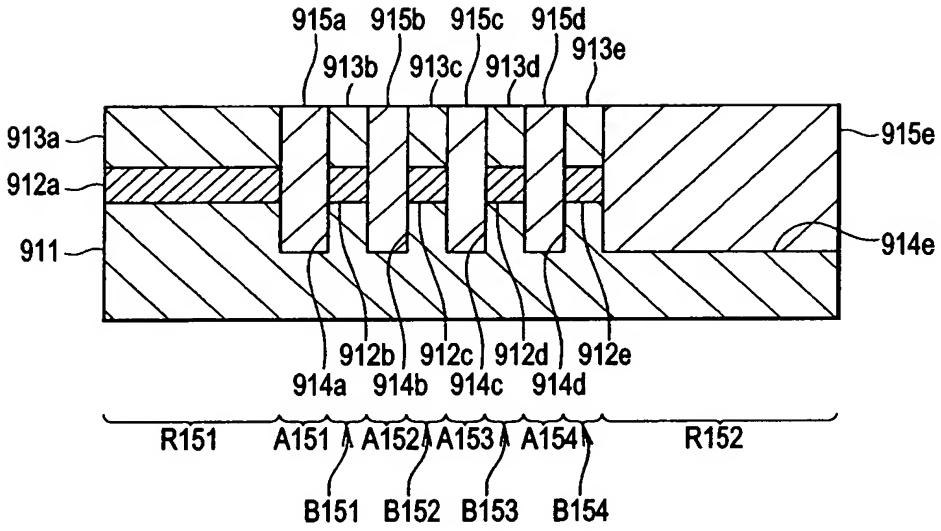
915a
915b
915c
915d
913b
913c
913d
913e
913a
912a
911
915e
914e
912b
912c
912d
912e
914a
914b
914c
914d
R151
A151
A152
A153
A154
R152
B151
B152
B153
B154

FIG.23

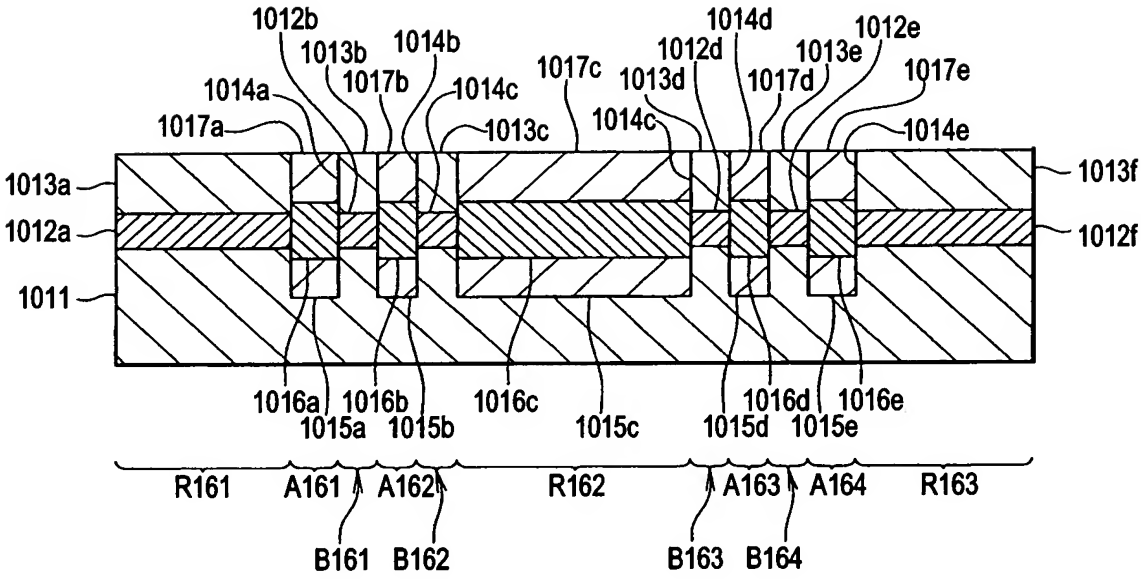
1012b
1013b
1014b
1017b
1014c
1017c
1013c
1014d
1012d
1013d
1017d
1012e
1013e
1017e
1014e
1014a
1017a
1014c
1013a
1012a
1011
1013f
1012f
1016a
1016b
1016c
1016d
1016e
1015a
1015b
1015c
1015d
1015e
R161
A161
A162
R162
A163
A164
R163
B161
B162
B163
B164

FIG.24

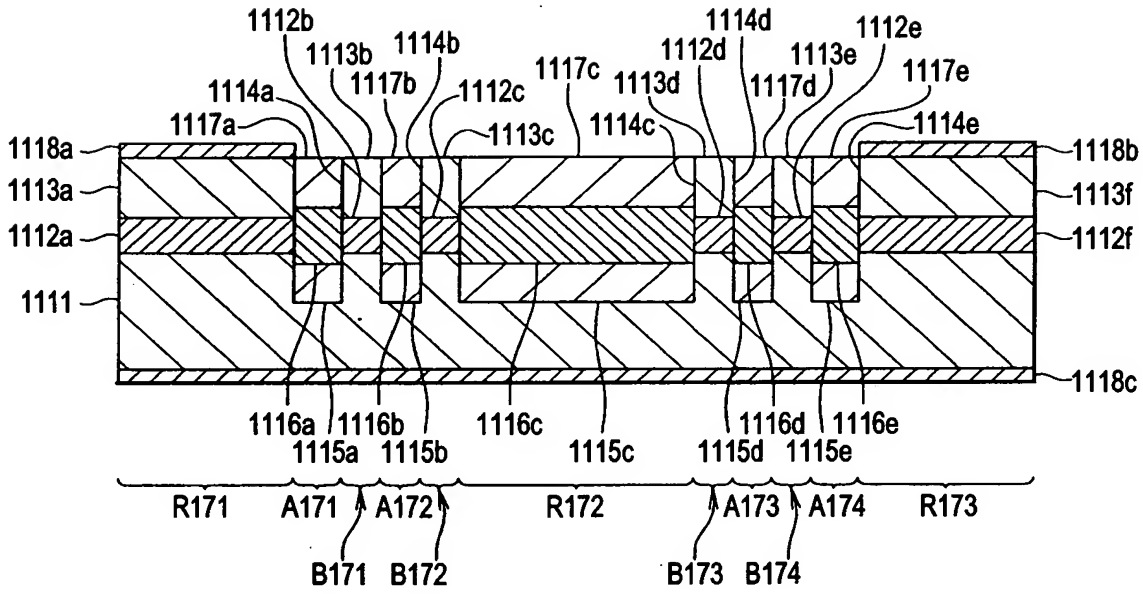
1112b
1113b
1114b
1114a
1117b
1112c
1117c
1113d
1114d
1112d
1113e
1112e
1117e
1117a
1113c
1114c
1117d
1114e
1118a
1113a
1112a
1111
1118b
1113f
1112f
1118c
1116a
1116b
1116c
1116d
1116e
1115a
1115b
1115c
1115d
1115e
R171
A171
A172
R172
A173
A174
R173
B171
B172
B173
B174

FIG.25

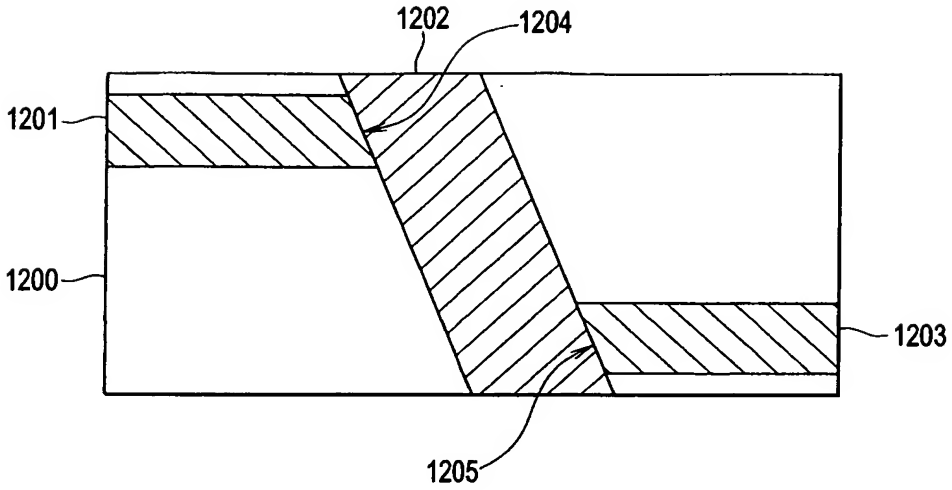

FIG.26

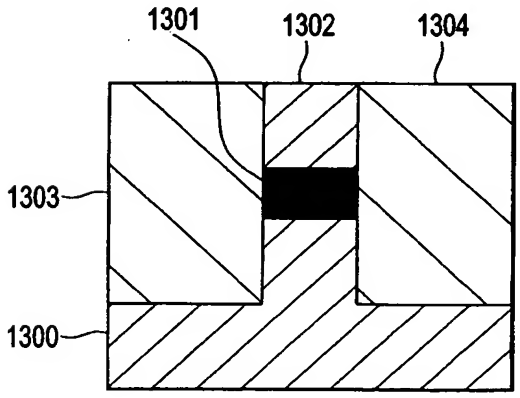

FIG.27

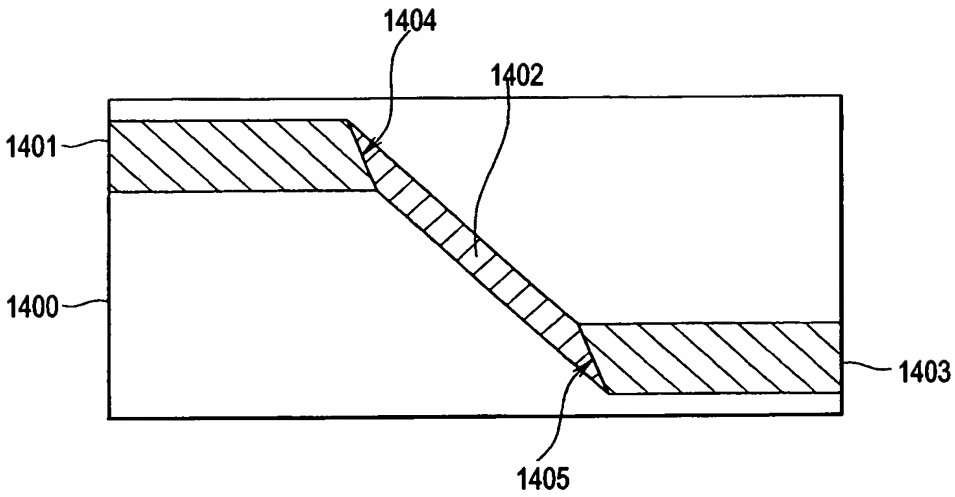

FIG.28

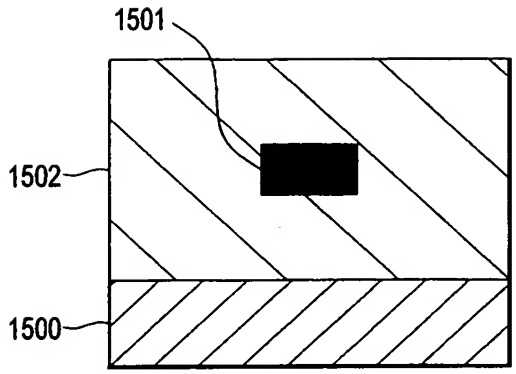

FIG.29

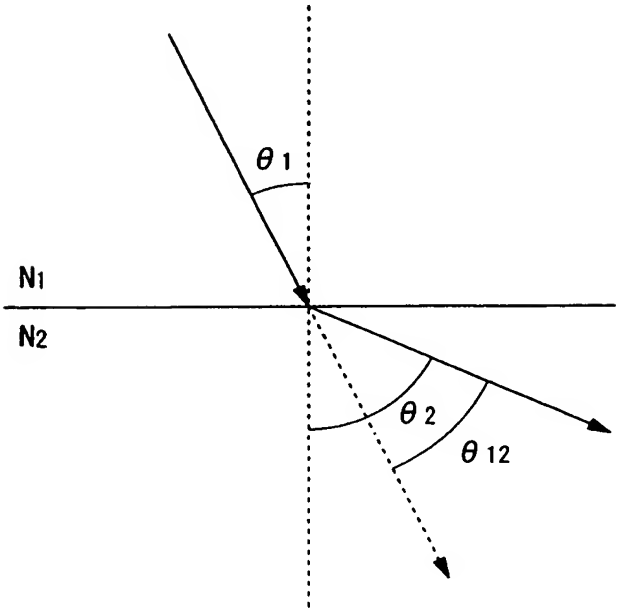

FIG.30

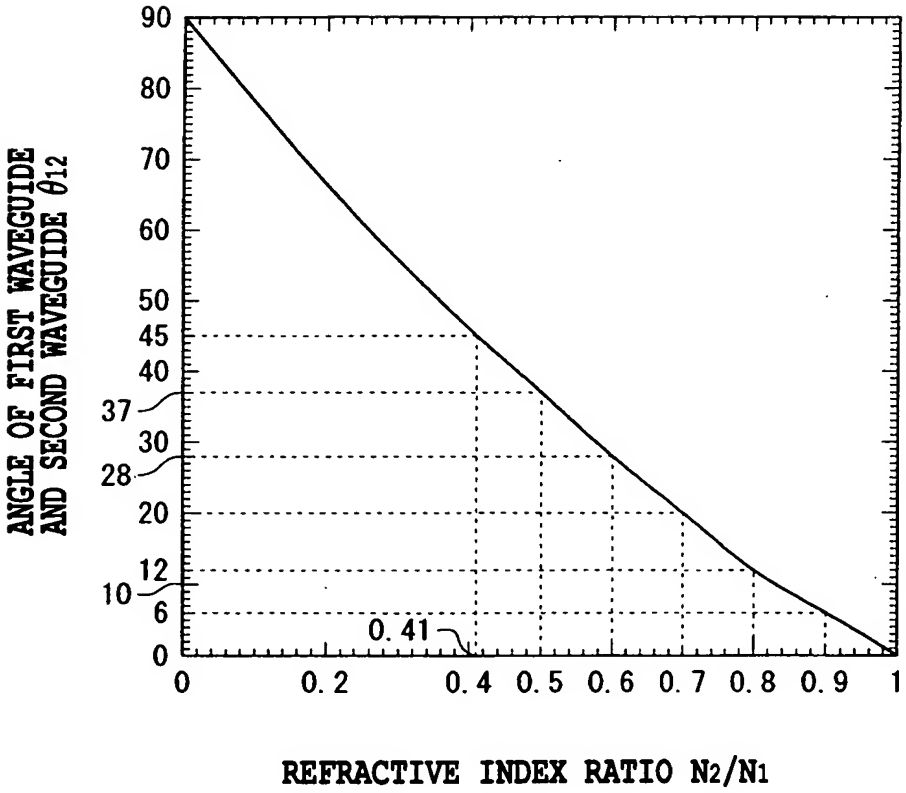
ANGLE OF FIRST WAVEGUIDE AND SECOND WAVEGUIDE θ12
90
80
70
60
50
45
40
37
30
28
20
12
10
6
0
0.41
0
0.2
0.4
0.5
0.6
0.7
0.8
0.9
1
REFRACTIVE INDEX RATIO N2/N1

FIG.31

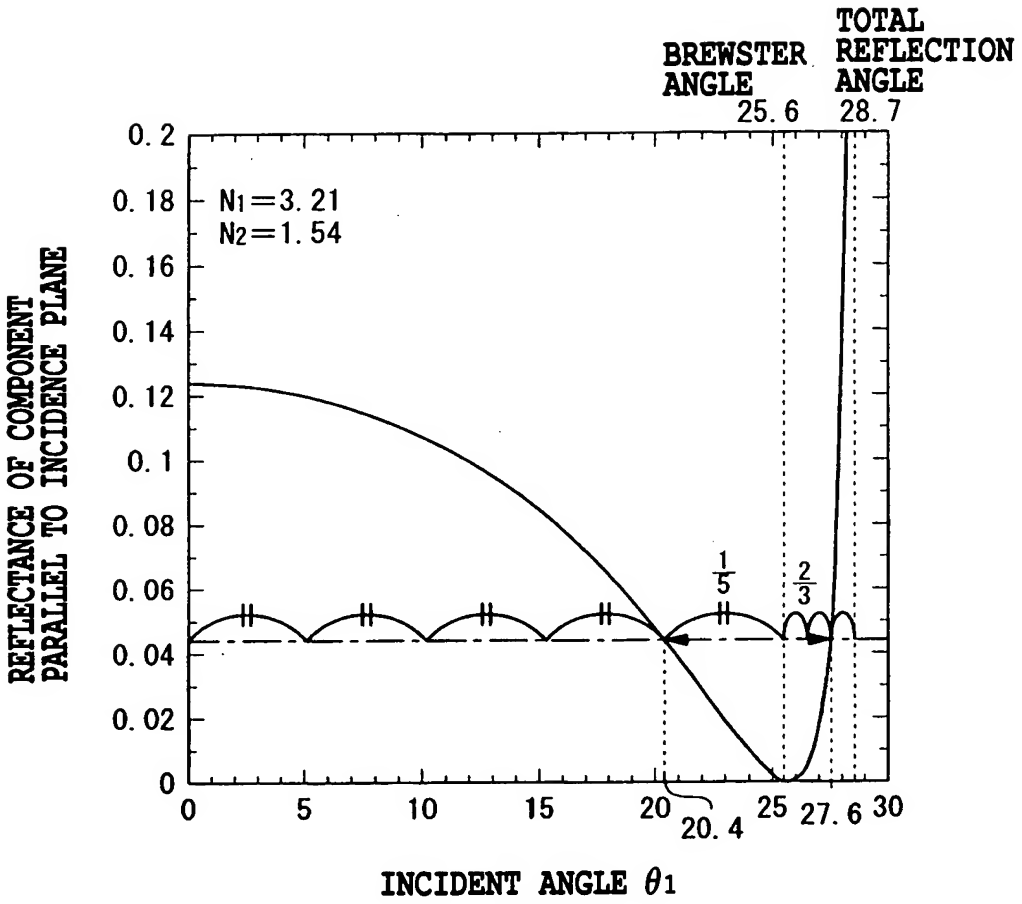
BREWSTER ANGLE
25.6
TOTAL REFLECTION ANGLE
28.7
N1=3.21
N2=1.54
REFLECTANCE OF COMPONENT PARALLEL TO INCIDENCE PLANE
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1/5
2/3
0
5
10
15
20
20.4
25
27.6
30
INCIDENT ANGLE θ1

FIG.32

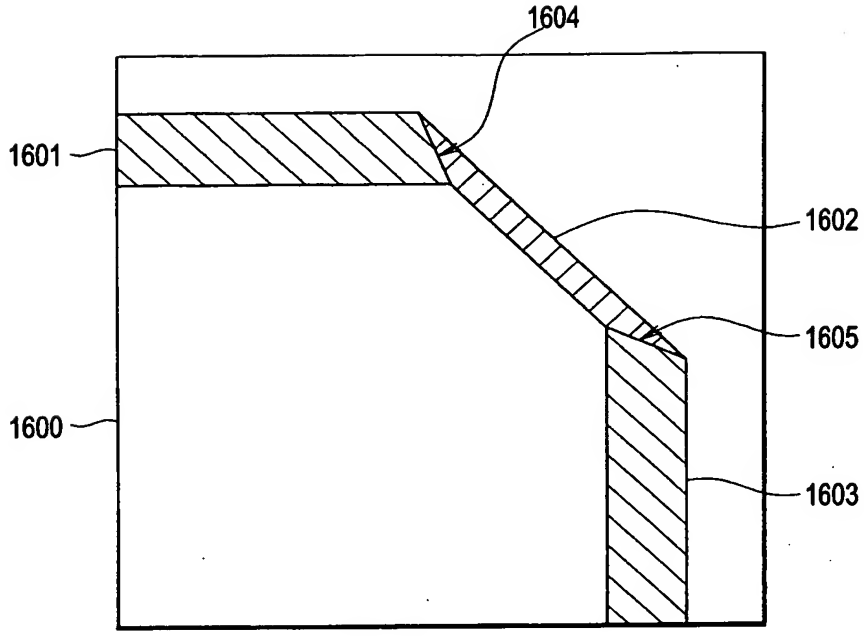
1604
1601
1602
1605
1600
1603

FIG.33

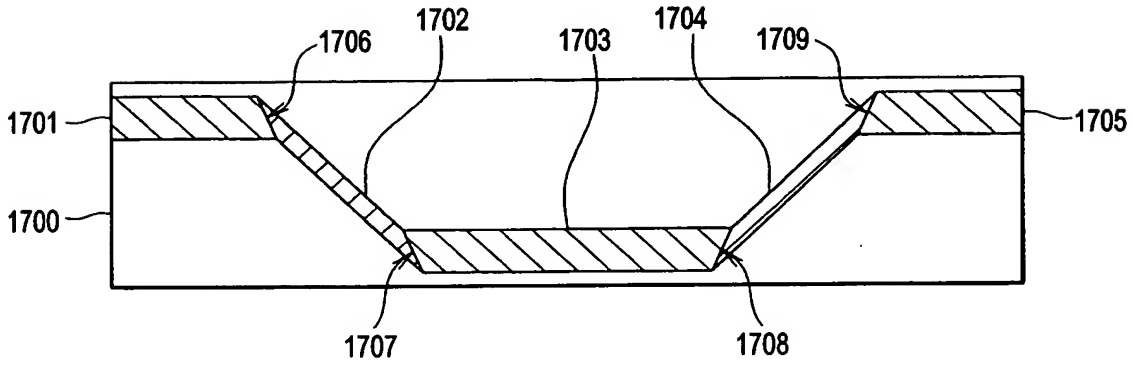
1706
1702
1703
1704
1709
1701
1705
1700
1707
1708

FIG.34

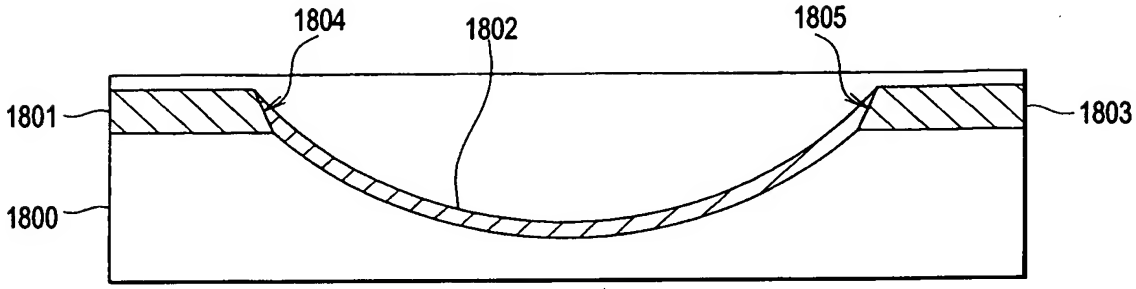
1804
1802
1805
1801
1803
1800

FIG.35

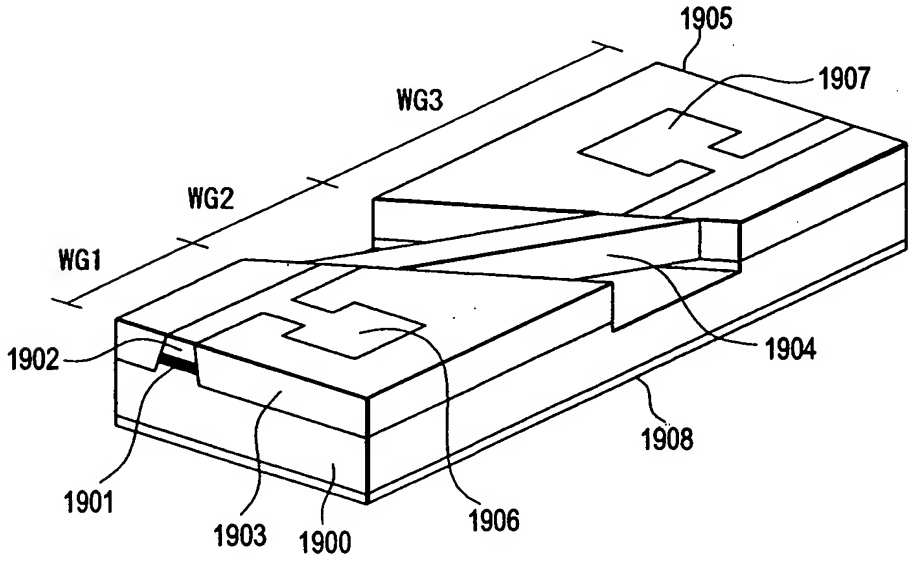
1905
1907
WG3
WG2
WG1
1902
1904
1908
1901
1903
1900
1906

FIG.36